Before the
**FEDERAL COMMUNICATIONS COMMISSION**
Washington, D.C. 20554

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| In the Matter of | |
| Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies | FCC Docket No. 92-9 |



COMMENTS OF NORTHERN TELECOM INC.

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## SUMMARY

Northern Telecom believes that the prompt identification of appropriate and adequate spectrum for emerging technologies, such as Personal Communications Services ("PCS"), is essential for the timely and meaningful deployment of such services.

Specifically, Northern Telecom supports the eventual allocation of 230 MHz of spectrum in the 1.7 to 2.2 GHz band on a primary basis for exclusive use by terrestrial PCS systems. In the short term, the Commission should begin by allocating approximately 10 MHz of spectrum in this band for the assessment of market requirements and should consider the co-primary allocation in lower bands consistent with actions taken internationally. In the mid term, an additional 60 MHz in the 2 GHz band will be needed for new-low power PCS standards. During these transitional phases of PCS, coordinated sharing with fixed services sharing the spectrum should be implemented to prevent harmful interference.

Moreover, applicants who demonstrate to the FCC that their service maximizes value to users through the responsible development and use of industry-approved common standards should be given priority in the allocation of spectrum. To provide service synergy and prevent market fragmentation, it is important that a single common air interface ("CAI") be adopted to foster the development of competitive public systems.

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COMMENTS OF NORTHERN TELECOM INC.

Northern Telecom Inc. ("Northern Telecom") hereby comments on certain issues raised in the Commission's Notice of Proposed Rule Making to reallocate spectrum to encourage the use of new telecommunications technologies. Northern Telecom views this Notice of Proposed Rule Making ("NPRM") as an appropriate and timely first step to upcoming Commission proceedings designed to focus on spectrum use, standards and regulatory issues. As detailed in these comments, Northern Telecom believes that Personal Wireless Systems (hereinafter Personal Communication Services ("PCS")) enabled by this and subsequent FCC decisions, will facilitate the introduction and evolution of emerging technologies, and will be an integral component in meeting the United States' telecommunications infrastructure and service needs. Northern Telecom believes that PCS will serve a variety of telecommunications needs including, but not limited to, wireless access to new and existing service providers. In addition, Northern Telecom believes the prompt identification of

appropriate and adequate spectrum will enhance business growth for American communications manufacturers, and equally important, that PCS will enhance business growth for all U.S. industries by enhancing productivity. Thus, Northern Telecom supports the Commission's goal as announced in this proceeding of the deployment of new telecommunications technologies. Northern Telecom believes that timely reallocation of spectrum will best allow the Commission to meet that important goal.

Northern Telecom is a world leader in manufacturing telecommunications equipment, and is uniquely qualified to address the Commission's questions regarding spectrum reallocation for PCS in Docket 92-9. Northern Telecom is the leading global supplier, in 90 countries, of digital telecommunications switching systems, providing products and services to the telephone operating companies, governments, and other institutions worldwide. Northern Telecom has some 60,000 employees, and had revenues in 1991 of $8.2 billion. The outcome of this proceeding will have significant impact on the design and markets for telecommunications equipment manufactured by Northern Telecom.

The views presented in this filing are the result of research performed by Northern Telecom's in-house laboratory, BNR, and Northern Telecom's first-hand experience with PCS in Europe, the United Kingdom, Canada and Pacific Rim countries. Among its activities in the United States, Northern Telecom has been a strong participant in PCS service trial activities,

industry standards committees and associations, and equipment design and manufacturing.

### The Commission Should Allocate 230 MHz of Spectrum to Be Dedicated Solely for PCS Purposes

Northern Telecom estimates that 230 MHz of spectrum will eventually be required for terrestrial PCS applications, and believes that the Commission's proposal to allocate spectrum for emerging technologies can accommodate that need. The amount of spectrum necessary for PCS is dependent on the number of public service providers, the compatibility of air interfaces and internetwork standards, the band or bands in which the spectrum is awarded, and the chronological sequence of service evolution and spectrum reallocation. Northern Telecom's estimates for PCS spectrum requirements have been calculated based on PCS service penetration in the U.S. population that would approach approximately 30% or more for business and residential services. In deriving this estimate, Northern Telecom included both voice and data applications, made assumptions for reasonable subscriber densities, and assumed a multiple operator scenario (~10% cost). Voice services comprise about 70% of total spectrum requirements. Although a single operator would be theoretically the most spectrum efficient, Northern Telecom urges the Commission to adopt rules that encourage competition between PCS service providers.

Northern Telecom's spectrum estimates are in line with the International Radio Consultative Committee ("CCIR") estimates of spectrum needs. Considerable activity by CCIR has taken place for the estimation of amount of spectrum required for personal communications. A special Joint Interim Working Party ("JIWP") for the 1992 World Administrative Radio Conference ("WARC '92") was created to develop a report from CCIR for WARC '92 on technical and operational issues. With respect to personal communications (also referred to as Future Public Land Mobile Telecommunications Systems ("FPLMTS"), the international term for PCS), the finding of this JIWP to WARC '92 was that 230 MHz of spectrum would need to be allocated on a worldwide basis for personal communications. The bands designated for FPLMTS at WARC '92 are: 1885-2025 MHz and 2110-2200 MHz, making a total of 230 MHz.

To the extent practical, the Commission should attempt in this proceeding to align spectrum in the United States with the international agreements made recently at WARC '92. Manufacturers can produce PCS equipment much more efficiently resulting in lower cost to the public through manufacturing economies of scale if there is a worldwide spectrum allocation.[1/]

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1/ For a detailed analysis of U.S. PCS spectrum needs, see Northern Telecom's PCS Technical Paper in Support of En Banc Hearing, December 5, 1991.

## The Commission Should Consider Spectrum Bands in the 2 GHz Range for the Deployment of PCS

The 230 MHz of spectrum that is needed for the long term deployment of PCS should be located in the 2 GHz range (1.7-2.2 GHz). The reasons are threefold: 1) the 2 GHz range can maximize the values derived from these services; 2) the 2 GHz range offers manufacturing feasibility, thereby allowing for high quality and functionally efficient PCS products; and 3) allocation of spectrum in the 2 GHz range is consistent with the recommendations for WARC '92, thereby achieving international compatibility of PCS products. On a final note, Northern Telecom believes a reallocation of adequate spectrum for PCS can begin in the 1850 MHz band and continue through spectrum bands that start at 1885 MHz as recommended for PCS at the WARC '92 conference.

## Maximum Value to the User

The availability of common spectrum for multiple user groups -- private residential, public access, and business (Key System, PBX or Centrex) -- will create greater incentives for development of standards and integrated network personal communications services. Primary allocations in the 2 GHz range could facilitate earlier deployment of services and less expensive equipment through manufacturing economies of scale.

To provide the maximum value to the general public, the following features should be integrated into all PCS systems:

- nationwide services, including nationwide customer roaming
- nationwide operation without requiring complex frequency coordination
- common air interface ("CAI")[2/]
- no need for terminal user licensing
- large customer base and consequent economies of scale for development and manufacture of equipment and services
- low cost, reliable and fully robust services

All of these features can be supported by the Commission's proposal to allocate spectrum in the 2 GHz range.

The availability of common spectrum in the 2 GHz range will also foster the development of a CAI. Common spectrum will allow the basic interoperability of equipment and services between serving areas. Service providers and customers will be assured of the availability of spectrum in each service area, without the need to compete with other services for the spectrum.

## Manufacturing Feasibility

The bands identified by the Office of Engineering and Technology ("OET") facilitate manufacturing feasibility for diverse product lines and maximum quality. Radio technology cost, size and reliability are significantly affected by the spectrum selected. Northern Telecom agrees with the OET that

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2/ A common air interface ensures the compatibility between base stations and mobile stations, regardless of the equipment manufacturer or locale in which such equipment is used.

spectrum for emerging technologies should be in bands below 3 GHz, and also that the bands below 2.2 GHz identified in this NPRM are particularly well suited for PCS. If CAIs and network standards are established, manufacturers can produce systems at significantly reduced costs to the public, and the equipment can be used throughout the country without being limited to small local areas.

International Compatibility

The Commission should support a domestic PCS spectrum usage plan that is consistent, either initially or as deployment plans allow, with the proposed international spectrum allocations for FPLMTS. Such an approach will lead to opportunities for high volume manufacture of the PCS equipment. This common spectrum allocation will lead to the rapid availability of cost effective equipment, and will maximize opportunities for export of equipment by U.S. manufacturers. Thus, the bands cited by the OET to reallocate for emerging technologies (1.85-1.99 GHz, 2.11-2.15 GHz, and 2.16-2.2 GHz) are ideally suited for PCS, and consistent with the recent allocations for FPLMTS at WARC '92.

In addition to the 2 GHz range allocations, to promote business growth for American equipment manufacturers, the Commission should also consider additional spectrum allocations in this proceeding that take advantage of spectrum allocations in countries that have strong trade relationships with the United States. Currently, the two countries with the largest amount of

trade and travel between the U.S. are Mexico and Canada. Moreover, in view of the Free Trade Agreement with Canada and the negotiations for a similar arrangement with Mexico, the FCC should strive to create a coordinated telecommunications system to match the emerging North American market. To maximize business opportunities for U.S. manufacturers in this North American market, the Commission should consider a prompt allocation of spectrum bands that have been allocated for PCS in Canada, Region 2-Americas, and in the Pacific Rim.

The commonality of the public telecommunications services in the American region (dialing plan, billing, network standards, etc.) has facilitated much international communications traffic. Similarly, a common North American PCS frequency allocation and common standards would greatly facilitate subscriber roaming, opportunities for service providers and increased market opportunities for manufacturers. Northern Telecom urges the Commission to continue its work with other regulators in North America to achieve a common PCS spectrum allocation.

In a broader sense, the Commission can achieve a more competitive market with the lowest possible subscriber cost by optimizing the match between international and U.S. positions on all aspects of PCS, including the subject of this NPRM, spectrum reallocation.

## The Commission Should Allocate Spectrum on a Primary Basis for Terrestrial PCS While Encouraging Interim Spectrum Sharing for Rapid PCS Deployment

Northern Telecom believes that in the mid term (1994-95) and long term (year 2000 time frame), the Commission should allocate a block of spectrum in the 2 GHz band on a primary basis for exclusive use by terrestrial PCS systems. This spectrum should be allocated in such a way that it can be shared by PCS systems in an equitable manner across all service applications (private residential, business and public access).

To provide service synergy and prevent market fragmentation, it is important that a single CAI should be adopted in order to foster the development of competitive public systems. By this means, problems associated with market utilization of dual standards (as occurred with BETA and VHS in the VCR market) can be avoided. Further, Northern Telecom encourages the Commission to support a CAI that also interworks with private systems so that private users may gain access to public systems where appropriate. Spectrum allocated to private and public systems should also be shared or adjacent so as to facilitate the use of common mobile equipment in multiple systems. Adequate spectrum should be available for competing PCS services. Spectrum sharing on a co-primary basis, in the medium and long term, with other users that are not PCS would result in an inefficient use of spectrum and would diminish the value of PCS to the general population and American industry.

Coordinated Sharing

There are means to facilitate PCS sharing spectrum with fixed services during the transitional phases of PCS introduction. Fixed services operating as point-to-point links generate and are sensitive to interference on the same frequencies only within the immediate area surrounding the beam path and the antennas.[3/] In the case of a high capacity, major telecommunication trunk link, the dimensions of this contour may be as large as sixty miles in length and tens of miles in width.

To prevent harmful interference, coordination is required to enforce the restriction that no low power PCS radio station shall be permitted to operate on channels that overlap the operating channels of the fixed system within the geographic region of the fixed system. This may be achieved by designing the low power PCS system in a manner such that the portable stations do not transmit without receiving instructions as to suitable local channel assignments from the base stations. The base stations must have knowledge of suitable operating channel assignments for their region. Such an approach is similar to how current mobile cellular systems operate, although for different reasons.

The technologies of cellular frequency reuse, dynamic channel allocation and (digital) control channels provide opportunities for sharing of spectrum that were not possible with

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3/ This area may be outlined approximately by the 130 dB/20% path loss contour of the links.

the traditional allocation methods. Northern Telecom also notes that system concepts, such as the Southwestern Bell IMASS and Northern Telecom's PCI,[4/] promote the potential for early implementation using previously allocated but currently unused, or underused, blocks of fragmented spectrum.

Northern Telecom strongly supports the Commission's mission to foster competition and, accordingly, cautions the Commission to avoid allocation of spectrum to providers that use technology which inhibits other competing service providers from serving the same market. To achieve the positive benefits of competition the Commission is advocating, multiple PCS providers must be able to share spectrum in the same service area. The use of a CAI designed to provide dynamic co-existence without extensive prior coordination will meet this objective.

While code division multiple access ("CDMA") has the potential for coordinated sharing of spectrum between fixed microwave users and a PCS provider under some circumstances, avoidance technology must be used with CDMA for multiple providers to share the same spectrum.[5/] Northern Telecom is not aware of any CDMA tests with proven results for successful

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4/ Northern Telecom Response to Notice of Inquiry Relating to Establishment of Personal Communication Services, FCC Doc. 90-314 (Oct. 1, 1990); and Reply Comments on Issues, FCC Doc. 90-314 (Jan. 15, 1991); Southwestern Bell Application of SW Bell PCS, File No. 2195-EX-PL (Jul. 17, 1991).

5/ Avoidance technology is where different users avoid being in the same radio spectrum in the same location at the same time through some level of coordination.

spectrum sharing between two or more mobile service providers. Further, Northern Telecom is not aware of any CDMA tests where PCS successfully shared spectrum with fixed microwave users without the use of avoidance technology.

The terrestrial PCS spectrum allocation involving coordinated sharing may be divided into two segments: one for unlicensed shared usage (residential and business applications) and one for designated service providers who are providing some public access service. At the very least the two terrestrial services segments should have adjacent allocations to permit the interoperability of portable equipment between the two markets. It is expected that dynamic channel allocation and a CAI standard will allow PCS providers to share spectrum among themselves, and in some cases, with the fixed services.

### The Commission Should Establish a Proposed Schedule of Reallocation of Spectrum to Permit Early Development of PCS

As noted above, Northern Telecom encourages the Commission to set aside approximately 230 MHz of spectrum (in addition to the current cellular allocation) to serve the diverse uses of PCS services. Northern Telecom recommends that this spectrum be allocated in a phased manner.

In the short term (1992-93), approximately 10 MHz of this spectrum should be allocated for assessment of market requirements. This 10 MHz should be located in the 2 GHz range.

This is sufficient spectrum for trials and preliminary product development before the establishment of a complete set of standards. A minimum set of suitable common radio interfaces are currently being defined by the national and international standards bodies (Committee T1, Telecommunications Industry Association, and CCIR). Northern Telecom believes that while some spectrum should be released for near term trials, it is essential that significant spectrum be held in reserve until the CAIs are more fully defined. The Commission should also consider the co-primary allocation of spectrum consistent with that assigned in Canada in the 944-952 MHz band.[6/] In addition, when making such an allocation the Commission should factor in consistency with the WARC '92 agreements making the 942-960 MHz band co-primary for mobile applications in Region 2-Americas, and making the 864-868 MHz band co-primary to align with the European and Pacific Rim country's allocations. This should facilitate the allocation of common regional bands for near term opportunities based on currently available technologies. These bands should also be considered as candidates for early development on a co-primary basis. As previous experiences in Europe have demonstrated, telecommunications cannot stop at the borders.

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6/ For a fuller discussion of the utility of the 944-952 MHz band, see Technical Paper of Northern Telecom Inc. in Support of its Testimony at the En Banc Hearing on PCS, GEN Doc. No. 90-314 (January 9, 1992) at 21.

In the mid term (1994-95), an additional 60 MHz in the 2 GHz range will be needed for equipment designed for new low-power PCS standards, as the standards are defined.

In the long term (year 2000 time frame), 230 MHz of spectrum is needed for full ubiquitous system implementation.

For American equipment manufacturers to thrive in a highly competitive international market, it is critical that the Commission identify the spectrum bands that will be available for PCS as soon as possible. Planning for long term PCS requirements should begin immediately.[7/]

## The Commission Should Encourage Innovation in Service Offerings and Technology Only When These Innovations Are Compatible with Standards to Be Adopted

Northern Telecom believes that innovation in service quality or new technologies should be encouraged to the maximum extent possible. However, any innovation should be considered in light of its compatibility with established standards. In other words, any innovation which serves to stagnate the deployment of PCS due to incompatibility with other PCS systems would be counterproductive and should not be considered by the Commission. Applicants who can demonstrate to the FCC that their service maximizes value to the users through responsible development and

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7/ For a more detailed analysis of the aforementioned phased approach, see Northern Telecom's PCS Technical Paper in Support of En Banc Hearing, Doc. 90-314 (Dec. 5, 1991).

use of common standards should be given priority in the allocation of spectrum. Particularly significant are applicants who advance common standards through compatible enhancements to those standards. Examples of the resulting benefits of such innovation are: improved quality, enhanced spectrum efficiency, lower costs, better roaming capabilities, enhanced network interworking and support, wider choice of services and enhanced service reliability.

One of the primary services in PCS is roaming (indoor, outdoor, land, sea, air, citywide, nationwide, worldwide), and users will expect to have service transparency while roaming. The transparency of service will be critical for emergency and medical applications of PCS. It is therefore crucial that emerging systems comply with universal radio interface standards as well as common network standards. Innovative use of technology without standards would be of only limited value to users, and may even reduce certain benefits, such as service transparency or roaming capability. The loss of economies of scale would also result in higher costs to users. Innovative use of technology within the framework of standards is not only practical, but will always add value to users.

## The Industry Must Set Standards for Network Interworking

Network interworking promotes national services and expands the usefulness of wireless equipment for the public. Basic system standards for the U.S. market, similar to the Home Location Register Functions for GSM in Europe, will promote more usable services for the general population that can be economically incorporated in all U.S. systems. This in turn will enhance the competitiveness of U.S. manufacturers in domestic and international markets.

Northern Telecom believes that the U.S. should be able to avoid certain problems experienced in the United Kingdom relating to the lack of uniform standards. Northern Telecom's experience in the United Kingdom indicates that achieving industry consensus on a CAI standard, and a common spectrum allocation, is essential for the commercial viability of PCS services.

The Commission has requested some guidance regarding the criteria to be applied in determining if a service merits allocation of Emerging Technology spectrum. Northern Telecom restates its comments in Docket 90-314 that standards for network interworking are as important as the CAI for PCS. The FCC criteria for awarding spectrum in future allocation rules should take account of an applicant's adherence to industry-approved standards.

### The Deployment of PCS Must Occur Only When the Benefits of Public Safety Services Are at a Minimum Maintained, and Preferably Enhanced

PCS has the potential to enhance public safety services by providing new mass communication links between the general population and public safety organizations. Currently unmet safety needs can be served by providing the general public new continuous communication to public safety organizations. Medical and emergency PCS services will address two of the most serious concerns of the American people; personal safety and access to medical care. For the common citizen, PCS will raise existing telecommunications services to an unprecedented level of convenience. For elderly and sick people, for example, it can serve as a lifeline -- providing capabilities such as automated call-in checks and emergency calls for health services. PCS will also provide potential victims of crime with means to call out for help. In addition, PCS will permit either working parent to reach his or her children at any time or from any place. Thus, PCS has the potential to contribute to the nation's well-being and to make significant improvements in the quality of life of all citizens.

## CONCLUSION

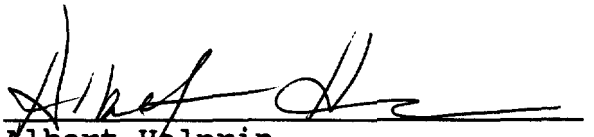
While the issue of spectrum reallocation is a fundamental step toward PCS deployment in the U.S., there is still a long road ahead. Northern Telecom applauds the

Commission's timely proposal for spectrum reallocation and encourages a similar sense of urgency on the follow-up issues of how that spectrum is to be allocated and used.

Northern Telecom has been an active participant since the early phases of the Commission's focus on PCS, and wishes to continue to assist the Commission on this extremely important initiative. Northern Telecom believes PCS has tremendous implications for this country's leadership in competitive global telecommunications markets, intelligent networks, and radio-based technologies. The Commission is to be highly congratulated in its efforts to assist in the development of this marketplace, and to bring about person-to-person communications in order to create a higher level of universal service.

Respectfully submitted,

NORTHERN TELECOM INC.



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